A. T. A.

OVERHAUL MANUAL

VARIABLE OXYGEN LINE PRESSURE REGULATOR

5425 SERIES

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VARIABLE OXYGEN LINE PRESSURE REGULATOR

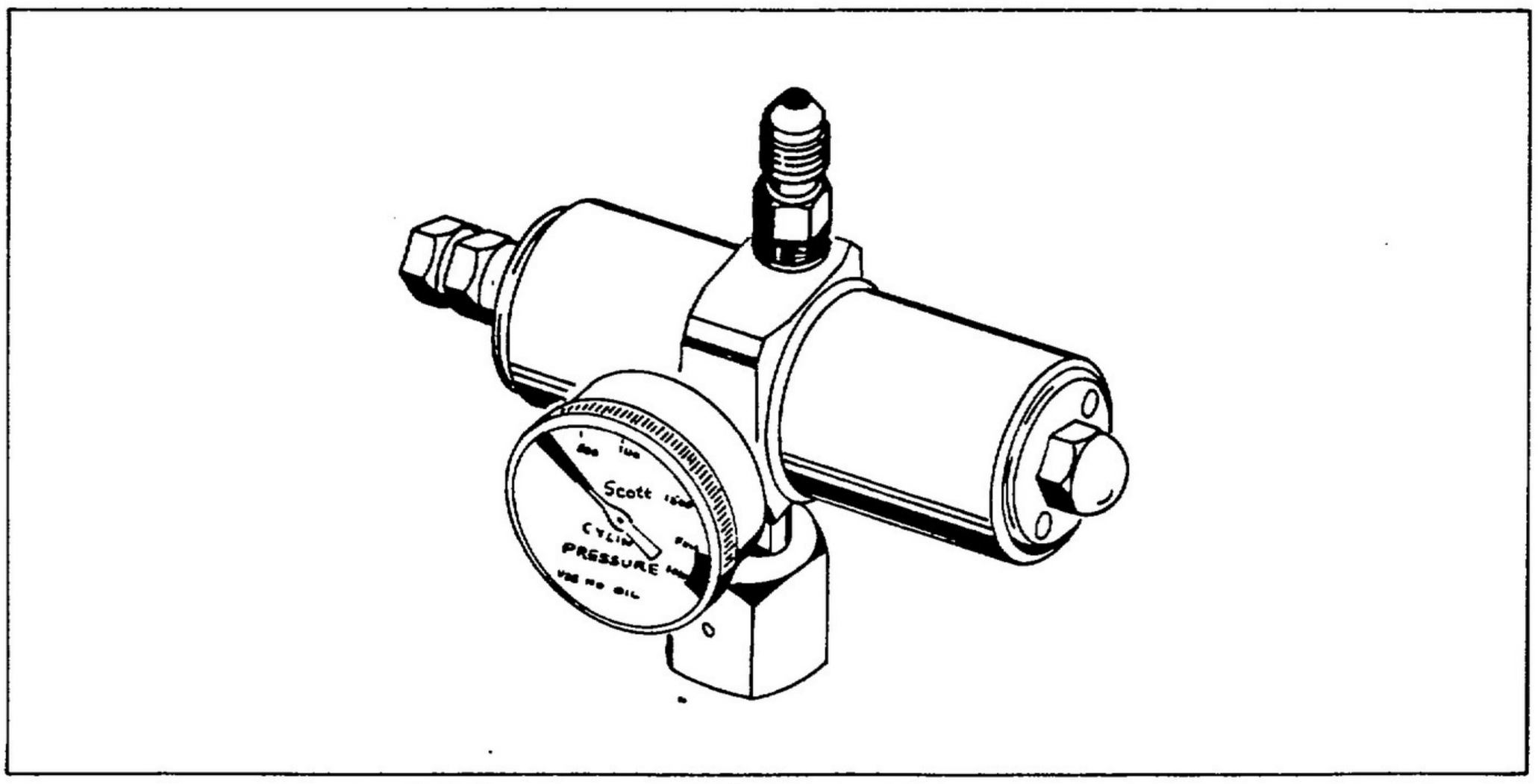
1. General

A. This manual provides overhaul instructions with illustrated parts list for Variable Oxygen Line Pressure Regulators, part numbers 5425, 5425-1, -3, -5 and -7. (See figure 1.) The basic regulators are identical and differ only in the types of inlet and outlet fittings, designated by dash numbers.

2. Description and Operation

A. Purpose of Equipment

(1) The variable oxygen line pressure regulator is used to reduce oxygen cylinder pressure (100 to 1800 psi) to a lower pressure (50 to 150 psi) in a linear relationship. Because of the linear relationship, the regulator outlet pressure is proportional to the pressure in the high pressure cylinder. This allows the use of a low pressure remote cylinder gage, to indicate oxygen supply, with a consequent elimination of a high pressure oxygen line.



Variable Oxygen Line Pressure Regulator
Figure 1

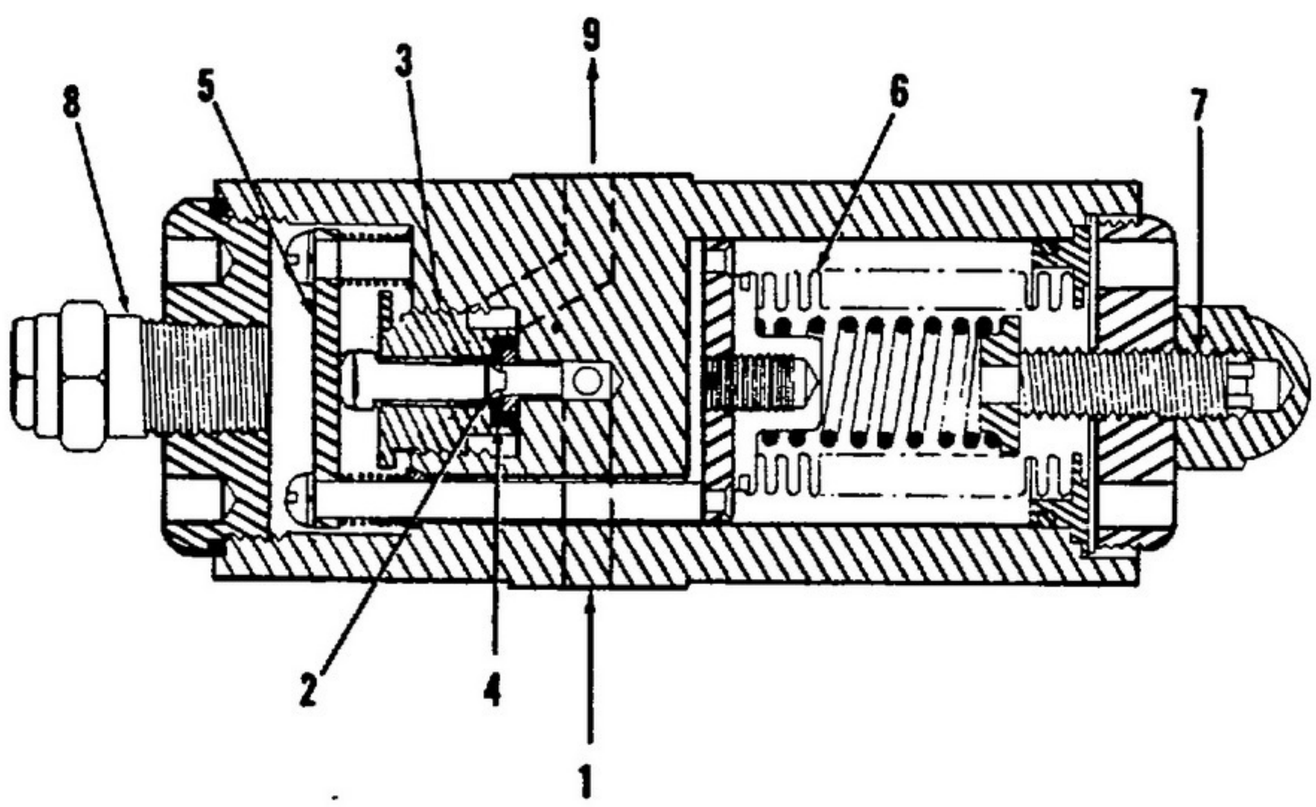
B. Typical Installation

(1) The regulator is designed for installation either directly on a high pressure oxygen cylinder valve or in a high pressure line near the high pressure source.

C. Operation (See figure 2.)

(1) High pressure oxygen enters the regulator at inlet port (1). The oxygen flows through internal porting to a high pressure oxygen gage which indicates the actual pressure of the oxygen in the high pressure cylinder.

(2) The oxygen also flows to valve (2). Valve (2) moves axially in valve seat retainer (3). High pressure cylinder oxygen acts on one end of the valve and tends to move the valve away from valve seat (4), thus allowing flow through the regulator. The opposite end of the valve is acted upon by mechanical valve lifter (5) actuated by bellows assembly (6), exposed to outlet pressure, which tends to close the valve.



1. INLET PORT
2. VALVE
3. VALVE SEAT RETAINER
4. VALVE SEAT
5. VALVE LIFTER
6. BELLOWS ASSEMBLY
7. ADJUSTING SCREW
8. RELIEF VALVE
9. OUTLET PORT

Composite Cross Section of Regulator
Figure 2

(3) During operation, inlet pressure acts on valve (2) to open the valve and allow flow. If the outlet pressure is less than the regulator outlet pressure setting, flow takes place. The flow continues until pressure increases sufficiently to cause bellows assembly (6) to contract enough to cause valve lifter (5) to close the regulator valve. When pressure on the bellows assembly decreases, through withdrawal of oxygen, the bellows assembly expands, moving valve lifter (5) away from valve (2). This enables inlet pressure to open the valve. This process repeats to maintain an outlet pressure in the range of 50 to 150 psi with inlet pressure of 100 to 1800 psi.

(4) The ratio of effective seat area, acted upon by inlet pressure, to effective bellows area, sensitive to outlet pressure, produces a linear relationship between inlet and outlet pressure.

(5) Regulated pressure can be adjusted by means of adjusting screw (7). Tightening the adjusting screw into the regulator body increases the regulated outlet pressure. Turning the adjusting screw out of the body reduces regulated pressure.

(6) A relief valve (8) is provided as a safety feature. It is set to open at a pressure below 200 psi and reseat above 165 psi.

3. Disassembly (See figure 9.)

NOTE: Prior to disassembling a 5425 regulator, note the dash number and determine the parts applicable to that assembly (refer to "EFFECT CODE" column of the Illustrated Parts List.) Disregard any instructions that do not apply to the particular assembly being overhauled.

A. Remove nameplate (6) and drive screws (8) only if they require replacement.

B. Remove plug (9) or unscrew gage (10) using a thin wrench on the flats of the gage mounting connection.

C. Unscrew outlet fitting (11) or nipple (12).

D. Unscrew inlet fitting (13) or (14) or unscrew coupling nipple (15) and remove nut (16).

E. Remove cap nut (20) and washer (21). Thread adjusting screw (22) out of body (55).

F. Use a spanner wrench and remove top cap (23). Remove slip ring (24), spring guide (25), regulating spring (26) and shim (27).

NOTE: Do not remove relief valve body (33) from bottom cap (34) unless it is damaged. Internal parts of the relief valve may be removed from body (33) while it is assembled to cap (34).

G. Unscrew cap (29) and remove spring (30) and poppet assembly (31). From the inside of cap (29) remove adjusting screw (32). Remove sealing compound from the threads of cap (29) and adjusting screw (32).

H. Use a standard spanner wrench and remove bottom cap (34). Take off cover gasket (35).

I. Remove valve lifter (37) from bellows guide assembly (51) by removing screws (38) and washers (39 and 40).

J. Remove springs (41) and bushings (42).

K. Remove retainer and valve kit (43). Remove valve seat (44), valve seat guide (45) and spring (46).

L. Grasp bellows assembly (47) or (49) and pull the bellows assembly and all parts attached to the bellows assembly out of body (55). Remove preformed packing (50) or gasket (48). Unscrew bellows assembly (47) or (49) from bellows guide assembly (51).

M. Pick filter (54) out of the inlet port. Discard the filter.

NOTE: Do not remove setscrew (53) and venturi (52) unless these parts are damaged and require replacement.

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4. Cleaning

WARNING: DO NOT ALLOW OIL, GREASE, FLAMMABLE SOLVENTS OR OTHER COMBUSTIBLE MATERIALS TO COME IN CONTACT WITH PARTS THAT WILL BE EXPOSED TO PRESSURIZED OXYGEN. SUCH MATERIALS, AS WELL AS DUST, LINT, AND FINE METAL FILINGS ARE ALL POTENTIAL COMBUSTIBLES WHICH MIGHT, WHEN EXPOSED TO OXYGEN UNDER PRESSURE, IGNITE AND RESULT IN AN EXPLOSION.

A. Using the materials listed in Table I, perform the cleaning procedures outlined in the following paragraphs:

MATERIAL	DESCRIPTION	USE	REFER TO PARAGRAPH
Trichlorethylene (Stabilized)	MIL-T-7003	Method A Cleaning	4.B.(1)

List of Cleaning Materials
Table I

B. Metal parts which have been contaminated can be cleaned by the following method using the materials listed in Table I.

(1) Method A. Use a vapor degreasing method with stabilized Trichlorethylene. Blow clean and dry with a stream of clean, dry, oil-free air or nitrogen.

C. Non-metallic parts such as silicone and rubber components may be cleaned by using an ultrasonic detergent and water cleaning system. Rinse parts in clean water and dry thoroughly before reassembly.

D. Remove dirt and foreign particles from equipment by wiping with a clean lint-free cloth, or by blowing clean, dry, oil-free air or nitrogen.

5. Inspection/Check

A. Visually inspect all parts for cracks, nicks, burrs or obvious damage.

B. Inspect all threads for condition and cleanliness.

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6. Repair

CAUTION: PROPER OPERATION OF THE REGULATOR DEPENDS ON A PERFECT INTER-RELATION OF CRITICAL PARTS. AT EVERY OVERHAUL, IF THE FOLLOWING PARTS ARE WORN OR DAMAGED, THEY SHALL BE REPLACED: RETAINER AND VALVE KIT (43, FIGURE 9). PROCURE THESE PARTS AS A SET AND INSTALL THEM IN THE REGULATOR AS A SET. THE PARTS LISTED ABOVE CONSTITUTE A SELECTIVE ASSEMBLY. DO NOT ATTEMPT TO MIX OR INTERCHANGE PARTS.

A. Repair of parts, other than removing burrs and chasing threads, is not recommended.

B. Replace gaskets (35 and 48, figure 9), preformed packing (50) and filter (54).

7. Fits and Clearances

None

8. Assembly (See figure 9.)

NOTE: Prior to reassembling a 5425 regulator, note the dash number and determine the parts applicable to that assembly (refer to "EFFECT CODE" column of the Illustrated Parts List.) Disregard any instructions that do not apply to the particular assembly being overhauled.

A. If venturi (52) was removed from body (55), place it in the body and position the venturi so that the cutaway portion faces the internal port (see figure 3). Install set screw (53).

B. Press filter (54) into the inlet port.

NOTE: Apply 1-1/2 wraps of sealing tape to the first three male threads only of all pipe threads, in a direction opposite to the running threads. Trim off excess tape.

C. Thread coupling nipple (15) with nut (16) into the regulator body inlet port and tighten the nipple using a wrench on the flats along the nipple body or thread inlet fitting (13 or 14) into body (55).

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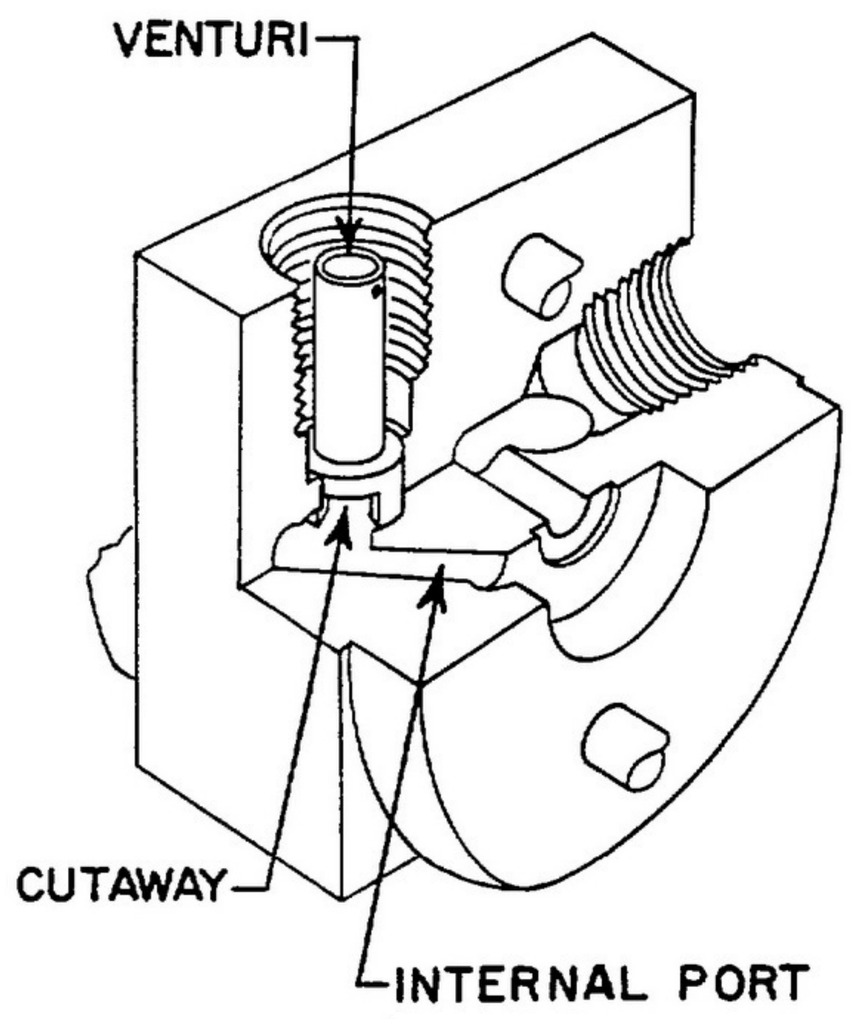
NOTE: Table II lists the consumable materials necessary for assembly.

MATERIAL	DESCRIPTION	MANUFACTURER*	REFER TO PARAGRAPH
Sealing Compound	Glyptal No. 1201	V01139	8.L.(5)
Leak Test Solution	Leak-Tek Formula 16-OX (MIL-L-25567)	V03530	9.A.(3) 9.A.(7)
Oxygen	MIL-O-27210 Type I	V07098	9.
Permacel Thread Sealing Tape	Permacel No. 412	V99742	8.B.

*Refer to paragraph 13.A.(4) for Vendors' Code.

List of Consumable Materials for Assembly
Table II



Venturi Installation
Figure 3

D. Screw outlet fitting (11) or nipple (12) into the regulator outlet port.

E. Thread gage (10) or plug (9) into the gage opening on body (55) and tighten, using a wrench on the flats of the gage mounting connection.

F. Screw bellows assembly (47 or 49) onto the extending stud of bellows guide assembly (51). Install preformed packing (50) or gasket (48) on the bellows assembly.

G. Insert bellows assembly (47 or 49), bellows guide assembly (51) and packing (50) or gasket (48) in body (55). Caution should be exercised upon insertion so as not to shear or damage packing (50) or gasket (48).

H. Insert shim (27) and regulating spring (26) into bellows assembly (47 or 49). Install spring guide (25) on the top of regulating spring (26). Position slip ring (24) and screw top cap (23) into body (55).

I. Install spring (46) and valve seat guide (45) into body (55). Insert valve seat (44) in retainer and valve kit (43) and screw retainer and valve kit with assembled parts into body (55).

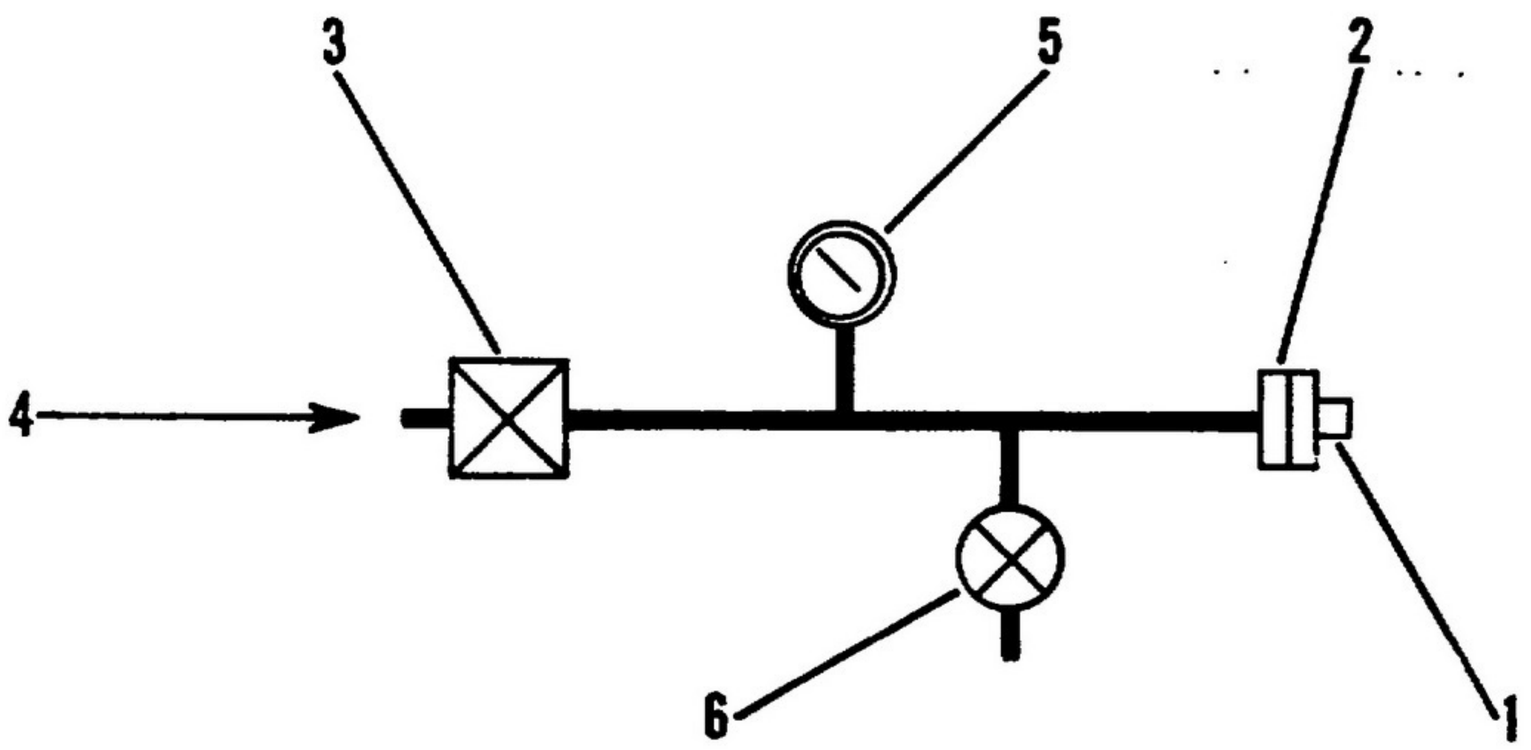
J. Place bushings (42) in body (55). Slide springs (41) over the extending legs of bellows guide assembly (51). Install valve lifter (37) and attach with screws (38) and washers (39 and 40).

K. If relief valve body (33) was removed from bottom cap (34), thread it into the cap and tighten it sufficiently to prevent leakage around the threads. Assemble the relief valve internal parts per instructions below.

(1) Place poppet assembly (31) and spring (30) into body (33).

(2) Screw adjusting screw (32) into cap (29) and screw this assembly into body (33).

L. Perform a relief valve adjustment test in accordance with the test setup illustrated in figure 4 and the following test procedure.



1. PART NUMBER 5431 CAP WITH RELIEF VALVE TO BE TESTED
2. TEST FIXTURE
3. PRESSURE REGULATOR - 0 TO 250 PSI
4. OXYGEN SUPPLY
5. PRESSURE GAGE - 0 TO 300 PSI
6. BLEED VALVE

Test Set Up For Relief Valve Adjustment
Figure 4

(1) Insert cap (34, figure 9) with relief valve assembled to it, into test fixture (2, figure 4).

(2) Apply oxygen pressure and adjust pressure regulator (3) to deliver 165 psi oxygen to the relief valve. The relief valve must hold at this pressure. If the relief valve fails to hold at 165 psi, insert an allen wrench through cap (29, figure 9) and thread adjusting screw (32) toward cap (34). This adjustment increases the relief setting of the relief valve. Adjust the adjusting screw until the relief valve holds at 165 psi.

(3) Increase the supply pressure to 200 psi. The relief valve must open at a pressure below 200 psi. If the relief valve does not open below 200 psi, thread adjusting screw (32) away from cap (34) until the proper setting is obtained.

(4) Reduce the pressure at the relief valve inlet to 165 psi, the relief valve must reseat above 165 psi.

(5) After proper adjustment is obtained, seal adjusting screw (32) to cap (29) with sealing compound.

M. Use a standard spanner wrench and screw bottom cap (34) with gasket (35) into body (55).

N. Thread adjusting screw (22) into top cap (23) several turns. Do not install cap nut (20) and washer (21) until completion of the test procedure, paragraph 9.

9. Testing

WARNING: IN THE TEST PROCEDURE LISTED BELOW, OXYGEN IS SPECIFIED AS THE TEST GAS. WATER PUMPED NITROGEN OR OIL-FREE AIR MAY BE SUBSTITUTED, BUT RESULTS MUST BE CONVERTED PRIOR TO BEING COMPARED WITH THE RESULTS SPECIFIED FOR OXYGEN. DO NOT, UNDER ANY CIRCUMSTANCES, USE OIL PUMPED GAS AS THIS WILL CAUSE CONTAMINATION OF THE REGULATOR AND TEST EQUIPMENT. OIL, EVEN IN MINUTE QUANTITY, COMING IN CONTACT WITH OXYGEN MAY CAUSE AN EXPLOSION OR FIRE.

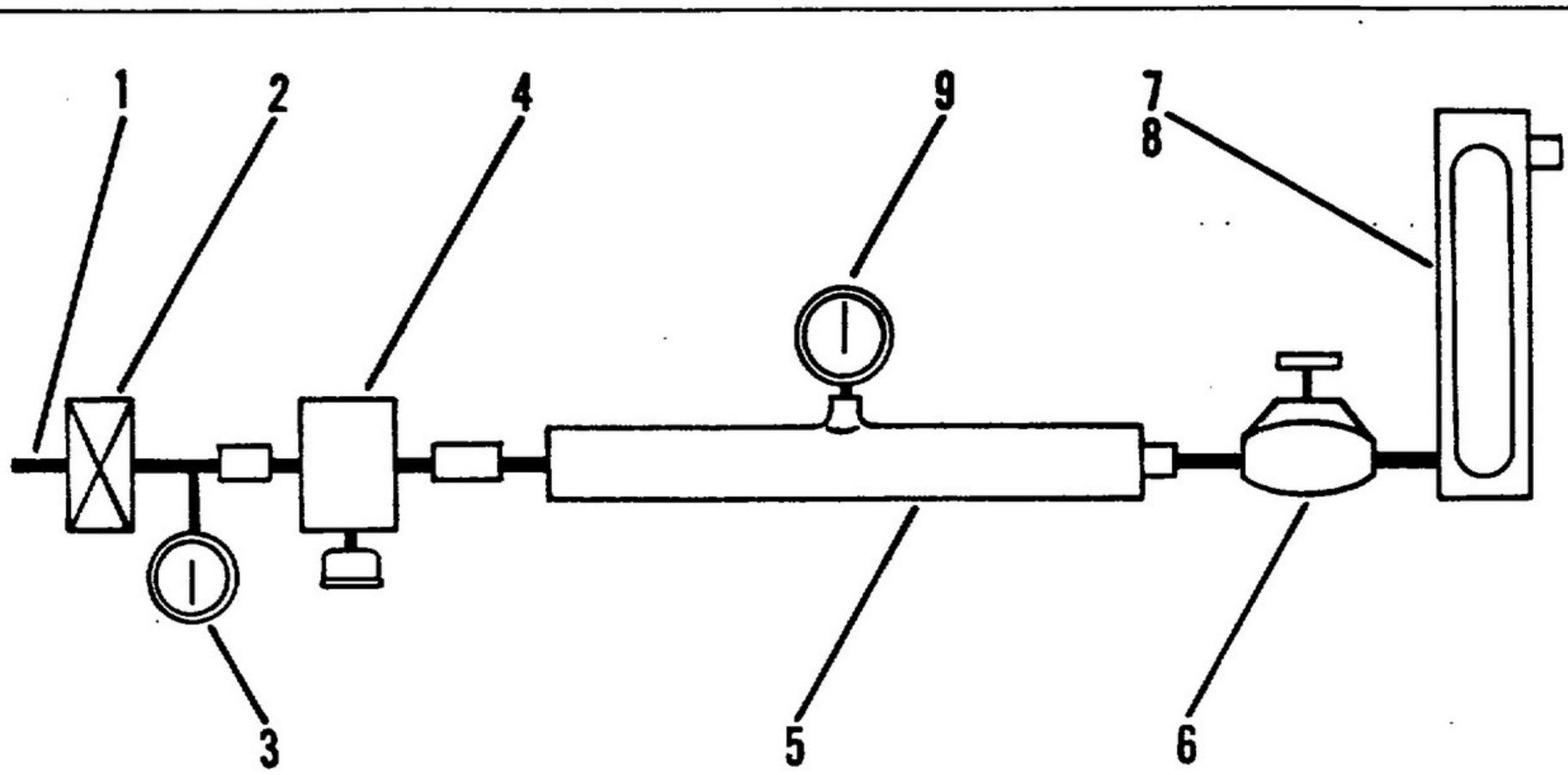
A. Perform a variable oxygen line pressure regulator test in accordance with the test setup illustrated in figure 5 and the following test procedure.

NOTE: The test setup from regulator (4) outlet to and including Clayton-Mark ball valve (6) must be leak tight.

(1) Adjust oxygen supply pressure to 1800 psi at the regulator inlet.

(2) With valve (6) closed, adjust screw (22, figure 9) per instructions below, until gage (9, figure 5) indicates 150 psi.

(a) If the pressure exceeds 150 psi, bleed the low pressure line by opening valve (6) and screw adjusting screw (22, figure 9) out of the regulator until the pressure is below 150 psi. Close valve (6, figure 5) and screw the adjusting screw into the regulator until 150 psi is obtained.



1. 2000 PSI OXYGEN SOURCE
2. 0-2000 PSI PRESSURE REGULATOR
3. 0-2000 PSI PRESSURE GAGE
4. 5425 REGULATOR
5. PIEZOMETER (SCOTT P/N 10260-T58-1)
6. ½" CLAYTON-MARK BALL VALVE (P/N 780TT) OR EQUIVALENT
7. FLOWMETER 10-100 LPM
8. FLOWMETER 50-500 LPM
9. 0-200 PSI PRESSURE GAGE

Test Setup For Variable Oxygen Line Pressure Regulator
Figure 5

(b) If the pressure is less than 150 psi, screw adjusting screw (22, figure 9) into the regulator until a reading of 150 psi is obtained.

(3) Apply leak test solution sparingly to all threaded caps and connections on the regulator body. No leakage is allowed. Blow clean and dry with oil-free air or nitrogen.

(4) Connect valve (6, figure 5) to flowmeter (7). Adjust valve (6) to allow 65 lpm flow through the regulator. Regulated pressure must remain at 150 ± 5 psi. Close valve (6) and disconnect flowmeter (7).

(5) Connect valve (6) to flowmeter (8). Open valve (6) fully. Flow measured on flowmeter (8) must exceed 400 lpm.

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(6) Repeat the following tests at each supply pressure listed in Table III.

(a) Close valve (6). Decrease the supply pressure to one of the values listed in Table III.

	SUPPLY PRESSURE - PSIG							
	1800	1500	1200	1000	700	500	300	100
Regulated Pressure 0 and 65 lpm Flow-psig	150.0 ±5	132.4 ±5	114.7 ±5	103.0 ±5	85.3 ±5	73.5 ±5	61.8 ±5	50.0 ±5
Minimum Flow Requirement - lpm	400	365	330	310	270	250	225	200

NOTE: Total pressure span from 0 to 65 lpm flow is 10 psi.

Flow and Outlet Pressure Requirements
Table III

NOTE: When making pressure flow checks during decreasing inlet pressures, valve (6) must be cracked before and during reduction of inlet pressure.

(b) Note pressure on gage (9). The pressure must fall within ±5 psi of the regulated pressure listed for the particular supply pressure.

(c) Adjust valve (6) to allow a flow of 65 lpm through the regulator. The regulated pressure must remain within ±5 psi of the listed value.

(d) Open valve (6) fully. The flow indicated on flowmeter (8) must exceed the value listed for the particular supply pressure.

(7) Throughout the tests, check pressure gage (10, figure 9) for accuracy by comparing its indication with the pressure indication on gage (3, figure 5). The pressure indicated on gage (10, figure 9) shall be within ±3% of the pressure indicated on gage (3, figure 5).

10. Trouble Shooting

A. See figure 6 for a chart containing troubles, probable causes and remedies.

TROUBLE	PROBABLE CAUSE	REMEDY
Leakage at inlet connection	Loose or defective nipple (15, figure 9)	Tighten or replace nipple
Leakage at outlet connection	Loose or defective fitting (11)	Tighten or replace fitting
Leakage through relief valve (28, figure 9)	Improperly adjusted or defective valve (28)	Adjust or replace valve
Leakage at relief valve (28) threads	Loose or defective valve (28)	Tighten or replace valve
Leakage at bottom cap (34)	Loose cap (34)	Tighten cap
	Defective gasket (35)	Replace gasket
Leakage at top cap (23)	Loose cap (23)	Tighten cap
	Defective, preformed packing (50) or gasket (48)	Replace preformed packing or gasket
	Faulty bellows assembly (47 or 49)	Replace bellows assembly
Leakage at gage (10) connection	Loose or defective gage (10)	Tighten or replace gage
Regulator cannot be adjusted to obtain proper regulated pressure	Bellows guide assembly (51) sticking	Replace bellows guide assembly
	Defective spring (26)	Replace spring

Trouble Shooting Chart (Sheet 1 of 2)
Figure 6

TROUBLE	PROBABLE CAUSE	REMEDY
Regulator cannot be adjusted to obtain proper regulated pressure	Defective retainer and valve kit (43), seat (44), guide (45), spring (46) and bellows assembly (47 or 49)	Replace retainer and valve kit, seat, guide, spring, and bellows assembly
Regulator fails to maintain proper relationship between supply and regulated pressure	Defective retainer and valve kit (43), seat (44), guide (45), spring (46) and bellows assembly (47 or 49)	Replace retainer and valve kit, seat, guide, spring, and bellows assembly
Regulator allows regulated pressure to creep	Defective retainer and valve kit (43), seat (44), guide (45), spring (46) and bellows assembly (47 or 49)	Replace retainer and valve kit, seat, guide, spring, and bellows assembly
Gage (10) does not indicate correct inlet pressure	Faulty gage (10)	Replace gage
Unable to adjust relief valve assembly (29 through 33) for proper operation	Defective poppet assembly (31)	Replace poppet assembly

Trouble Shooting Chart (Sheet 2 of 2)
Figure 6

11. Storage Instructions

A. Close all openings on the regulator body with protective plugs or thread protectors. This prevents dirt and foreign material from entering the regulator. Wrap the regulator in a clean plastic bag. Do not use preservative coatings of any kind.

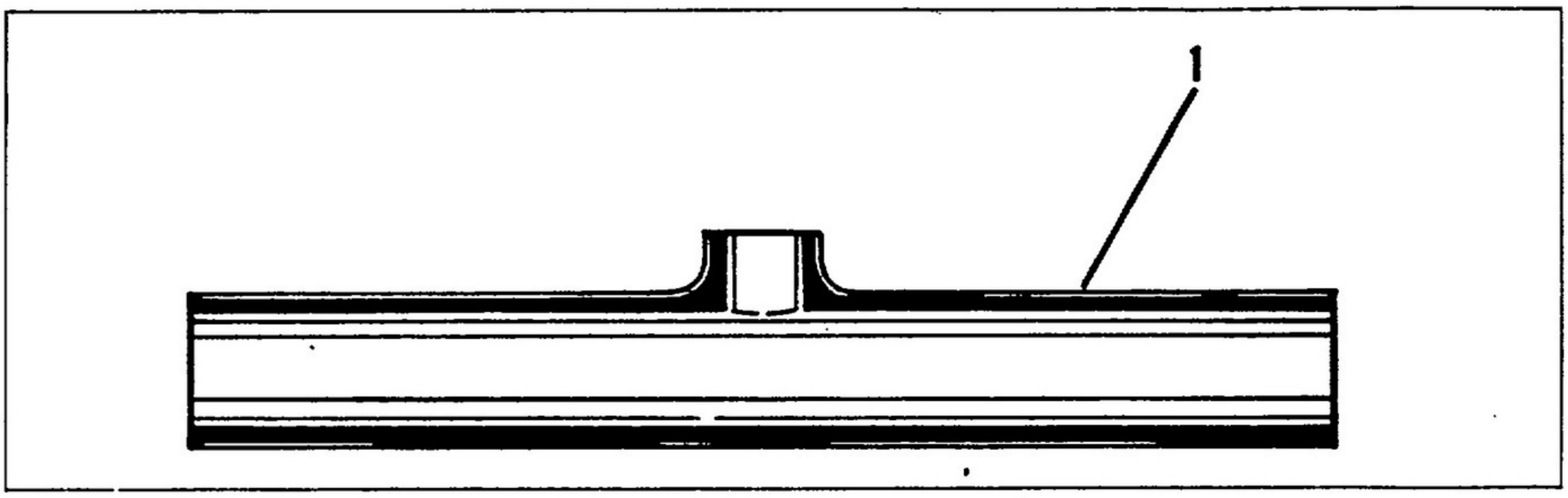
12. Special Tools, Fixtures and Equipment

A. All special tools and test equipment required to overhaul the regulator are listed in figure 7 and illustrated in figure 8.

FIGURE 8 ITEM NO.	PART NUMBER	PART NAME	APPLICATION
1	10260-T58-1	Piezometer	Used during final testing

Note: All special tools and test equipment listed are manufactured by Scott Aviation, Lancaster, New York

Special Tools and Test Equipment
Figure 7



Special Tools and Test Equipment
Figure 8

13. Illustrated Parts List

A. This Illustrated Parts List lists and describes the parts for the Variable Oxygen Line Pressure Regulator, part numbers 5425, 5425-1, -3, -5 and -7.

(1) The Group Assembly Parts List consists of a parts listing and a completely indexed drawing. The regulators are followed by their component parts, properly indented thereunder, to show their relationship to the assembly.

(2) The quantities listed in the "UNITS PER ASSY" column are in the case of assemblies, the total quantity used per regulator at the location indicated, while the component parts indented under the assemblies are the quantity used per assembly. The quantities specified, therefore, are not necessarily the total used per regulator.